

WHAT IS CLAIMED IS:

1. A catalyst degradation determining apparatus that determines whether a catalyst provided in an exhaust passage of an internal combustion engine has degraded, comprising a controller, wherein

5 the controller acquires a degradation index value that changes in accordance with a degree of degradation of the catalyst,

 the controller corrects the degradation index value acquired, based on a factor that affects the degradation index value, so that the degradation index value becomes equal to a post-normalization index value that is a degradation index value acquired
10 when the factor is a predetermined value; and

 the controller determines whether the catalyst has degraded, based on a result of comparison regarding whether the post-normalization index value is greater than a catalyst degradation criterion value.

15 2. The catalyst degradation determining apparatus according to claim 1, wherein the degradation index value that changes in accordance with the degree of degradation of the catalyst is a maximum oxygen storage amount of the catalyst.

 3. The catalyst degradation determining apparatus according to claim 2,
20 wherein the factor is a temperature of the catalyst.

 4. A catalyst degradation determining apparatus that determines whether a catalyst provided in an exhaust passage of an internal combustion engine has degraded, comprising:

25 a controller; and

 a data storage, wherein

 the controller calculates a maximum oxygen storage amount of the catalyst;

 the controller acquires a calculation period catalyst temperature that is a temperature of the catalyst during a period during which the maximum oxygen
30 storage amount is calculated;

 the data storage pre-stores relationships between the temperature of the catalyst and the maximum oxygen storage amount of the catalyst separately for individual degrees of degradation of the catalyst, and pre-stores a characteristic value that specifies the degrees of degradation corresponding to the relationships;

if a maximum oxygen storage amount is calculated and the calculation period catalyst temperature during the period of calculation of the maximum oxygen storage amount is within a predetermined temperature range, the controller determines the characteristic value of the catalyst occurring at a time point of calculation of the maximum oxygen storage amount based on the maximum oxygen storage amount and the calculation period catalyst temperature as well as the relationships and the characteristic value stored in the data storage;

if a maximum oxygen storage amount is newly calculated and the calculation period catalyst temperature during the period of calculation of the maximum oxygen storage amount newly calculated is not within the predetermined temperature range, the controller corrects the newly calculated maximum oxygen storage amount by normalizing the same amount so as to reach a post-normalization maximum oxygen storage amount that is a maximum oxygen storage amount when the catalyst has a predetermined normalization temperature, based on the characteristic value determined, the normalization temperature, and the calculation period catalyst temperature of the calculation period of the newly calculated maximum oxygen storage amount;

the controller determines whether the correction of the newly calculated maximum oxygen storage amount is appropriate; and

the controller determines whether the catalyst has degraded based on a result of determination as to whether the post-normalization maximum oxygen storage amount is greater than a catalyst degradation criterion value, when it is determined that the correction of the newly calculated maximum oxygen storage amount is appropriate.

5. The catalyst degradation determining apparatus according to claim 4, wherein the characteristic value stored in the data storage is a gradient of a linear expression of a relationship between the temperature of the catalyst and the maximum oxygen storage amount of the catalyst.

6. The catalyst degradation determining apparatus according to claim 4, wherein the predetermined temperature range is set as a range in which the maximum oxygen storage amount of the catalyst when the catalyst is to be determined as a degraded catalyst is always different from the maximum oxygen storage amount of

the catalyst when the catalyst is to be determined as an un-degraded catalyst even if the maximum oxygen storage amount of the catalyst calculated within the temperature range varies due to a measurement error, and the normalization temperature is set at a temperature within the predetermined temperature range.

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7. The catalyst degradation determining apparatus according to claim 6, wherein the characteristic value stored in the data storage is a gradient of a linear expression of a relationship between the temperature of the catalyst and the maximum oxygen storage amount of the catalyst.

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8. The catalyst degradation determining apparatus according to claim 7, wherein the controller is designed so as to determine a correction amount by multiplying a difference between the calculation period catalyst temperature during the period of calculation of the newly calculated maximum oxygen storage amount and the normalization temperature by the gradient of the linear expression that is the determined characteristic value, and determine the post-normalization maximum oxygen storage amount by correcting the newly calculated maximum oxygen storage amount with the correction amount; and

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the controller is designed so as to determine whether the correction is appropriate based on a ratio of the correction amount to the newly calculated maximum oxygen storage amount used in determining the post-normalization maximum oxygen storage amount, or a ratio of the determined gradient to the newly calculated maximum oxygen storage amount.

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9. A catalyst degradation determining method for determining whether a catalyst provided in an exhaust passage of an internal combustion engine has degraded, wherein

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a degradation index value that changes in accordance with a degree of degradation of the catalyst is acquired;

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the degradation index value acquired is corrected based on a factor that affects the degradation index value so that the degradation index value becomes equal to a post-normalization index value that is a degradation index value acquired when the factor is a predetermined value; and

whether the catalyst has degraded is determined based on a result of comparison regarding whether the post-normalization index value is greater than a catalyst degradation criterion value.

5 10. The catalyst degradation determining method according to claim 9, wherein the degradation index value that changes in accordance with the degree of degradation of the catalyst is a maximum oxygen storage amount of the catalyst.

10 11. The catalyst degradation determining method according to claim 10, wherein the factor is a temperature of the catalyst.

12. A catalyst degradation determining method for determining whether a catalyst provided in an exhaust passage of an internal combustion engine has degraded, wherein

15 a maximum oxygen storage amount of the catalyst is calculated;

 a calculation period catalyst temperature is calculated, which is a temperature of the catalyst during a period during which the maximum oxygen storage amount is calculated;

 relationships between the temperature of the catalyst and the maximum

20 oxygen storage amount of the catalyst are pre-stored separately for individual degrees of degradation of the catalyst, and a characteristic value that specifies the degrees of degradation corresponding to the relationships is pre-stored;

 if a maximum oxygen storage amount is calculated and the calculation period catalyst temperature during the period of calculation of the maximum oxygen storage

25 amount is within a predetermined temperature range, the characteristic value of the catalyst occurring at a time point of calculation of the maximum oxygen storage amount is determined based on the maximum oxygen storage amount and the calculation period catalyst temperature as well as the relationships and characteristic value stored;

30 if a maximum oxygen storage amount is newly calculated and the calculation period catalyst temperature during the period of calculation of the maximum oxygen storage amount newly calculated is not within the predetermined temperature range, the newly calculated maximum oxygen storage amount is corrected by being normalized so as to reach a post-normalization maximum oxygen storage amount that

is a maximum oxygen storage amount when the catalyst has a predetermined normalization temperature, based on the characteristic value determined, the normalization temperature, and the calculation period catalyst temperature of the calculation period of the newly calculated maximum oxygen storage amount;

5 whether the correction of the newly calculated maximum oxygen storage amount is appropriate is determined; and

 whether the catalyst has degraded is determined based on a result of determination as to whether the post-normalization maximum oxygen storage amount is greater than a catalyst degradation criterion value, when it is determined that the
10 correction of the newly calculated maximum oxygen storage amount is appropriate.